Comparing Covalent and Ionic Compounds

**Background Information**

Compounds are either covalent or ionic depending on the nature of the forces that hold them together. In ionic compounds, the force of attraction is between oppositely charged ions. This attraction is called an ionic bond. In covalent compounds, atoms are held together by an interaction between adjacent nuclei and shared electrons. These different forces account for many of the properties of ionic and covalent compounds, such as the degree of volatility (ability to turn into a gas) and solubility. In this investigation you will examine the properties of a representative ionic compound and a representative covalent compound. The properties studied will be 1) volatility, 2) ease of melting, and 3) solubility in water.

**Problem**

How do the properties of ionic and covalent compounds differ?

**Materials (per group)**

Bunsen burner ring stand ring clamp

Wire gauze safety goggles Crucible 2 test tubes

**Procedure**

1. Carefully smell each compound. If you can detect an odor, assume that the compound has a high volatility. Record your observations in the Data Table.
2. In turn, place small equal amounts of each substance in an evaporating dish. See Figure 1. Heat each sample with a burner flame and record the time required to melt each sample. Make sure the room is well ventilated. As soon as the compound melts, remove the flame. Record your results in the Data Table.
3. Put a few small crystals of each substance in separate test tubes containing several milliliters of water at room temperature. Shake or stir and record in the Data Table how rapidly the substances dissolve in water.

**Observations**

Data Table

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance** | **Volatility** | **Melting Time** | **Solubility** |
| Ionic compound |  |  |  |
| Covalent compound |  |  |  |

1. Which compound was more volatile?
2. Which compound melted more quickly
3. Which compound dissolved more easily in water?

**Analysis and Conclusions**

1. Explain why the type of bond could determine the volatility of a substance.
2. Does the strength of the bond have anything to do with the time it takes to melt a substance? Explain.
3. Water molecules have parts that are negatively charged and parts that are positively charged. Which substances tend to dissolve easier in water, ionic or covalent? Why?

**Critical Thinking and Application**

1. What does your data tell you about the melting points of ionic and covalent compounds?
2. Which do you think would be more dangerous near an open flame: an ionic or a covalent compound? Why?
3. Which type of compound-ionic or covalent-would you expect to have a higher boiling point? Why?
4. Suppose you had a sample of two compounds mixed together. Both compounds consist of fine white crystals. You know that one of the compounds is ionic and the other is covalent. How might you separate the two compounds?

**Going Further**

1. With adult supervision, test a variety of household materials to determine whether they are probably ionic or covalent. Vegetable oil, sugar, paraffin, and Epsom salts are possible choices.
2. Certain substances when dissolved in water will conduct an electric current. Find out whether such substances are more likely to be ionic or covalent